

**Amendments to the Specification:**

Please amend the specification as follows:

Please replace the existing title with the following title: "**MULTIPLE RECOGNITION IMAGE PROCESSING APPARATUS**"

Please replace the last paragraph on page 2 (lines 17-26) with the following rewritten paragraph:

As described above, it is clear that with the apparatus indicated by these cited documents, when a specified image information is image-processed, it is difficult to highly accurately recognize the region unless the macro-region information on the image information is obtained. However, to carry out pre-scanning in order to obtain macro information, there is a problem in that it becomes difficult to increase the image processing speed as much as the time required for pre-scanning.

Please replace the last paragraph on page 5 (lines 16-27) and continuing on page 6 (lines 1-11) with the following rewritten paragraph:

The construction and action of the image processing apparatus related to the first embodiment according to the present invention will be described in detail as follows. FIG. 1 is a block diagram showing a configuration example of the first embodiment of the image forming apparatus related to the present invention, and in FIG. 1, the image forming apparatus related to the present invention comprises a color transforming section 1 to which image information, etc. of the original document image is entered, space filter 2 which is connected to the color transforming section 1, and a neighborhood region recognizing section 3 which is connected to the color transforming section 1 in the same manner. From a scanner not illustrated, the RGB signal is read and entered in the color transforming section 1. The color transforming section 1 transforms the original document image into ink colors YMCK of the image forming apparatus (printer) based on the RGB signal. Specifically, this transformation processing takes place by interpolation with inputted three-dimensional table

four colors YMCK that correspond to inputted RGB in the 3-inputs-4-outputs transformation system.

Please replace the first full paragraph on page 7 (lines 6-23) with the following rewritten paragraph:

However, because at this point, the signal for controlling this space filter 2 primarily recognizes the edge component in the neighborhood region, it is unable to completely distinguish, for example, screened halftone structure and microscopic character, and there is a possibility to emphasize part of screened halftone noise or smoothen part of microscopic character. Therefore, the space filter 2 comparatively reduces the high-frequency portion contained in the character section. In this way, the picture quality is improved. Consequently, the space filter 2 carries out the picture quality improvement such as removing the frequency of screened halftone areas but emphasizing the profile of the character portion using a comparatively large size space filter such as 13 pixels x 13 pixels, etc. By the way, at this point, no strong emphasis (improvement) is carried out.

Please replace the last paragraph on page 7 (lines 24-27) and continuing on page 8 (lines 1-10) with the following rewritten paragraph:

The signal with the picture improved by this space filter 2 has the image compressed at the image compression processing section 4. For this compression processing, for example, the method recited in U.S. Patent Application No. 09/138284 may be used, but needless to say, the well-known JPEG (Joint Photographic Coding Experts Group) technique may be used. In the method recited in U.S. Patent Application No. 09/138284, it is recited that the picture quality could be improved by compressing after receiving the recognition signal as to whether the it is the character edge or halftone area when compression processing is carried out. Then, the compressed signal is stored into the memory element 5.

Please replace the first full paragraph on page 9 (lines 3-17) with the following rewritten paragraph:

The image region recognition signal stored in the recognition section of memory element 5 recognizes whether the region is the character region or photograph region (including screened halftone areas) by the neighborhood image dots characteristics only. Consequently, at the edge section of the photograph region, etc., it is difficult to distinguish the character region edge and errors may result. Therefore, the recognition errors as mentioned above can be remarkably reduced by observing the layout of the whole image and determining whether it is the character region or photograph region by judging ~~by~~, for example, arrangement of characters, etc. For this kind of system, macro region recognition (recited in U.S. Patent Application No. 09/136929) is effective.

Please replace the last paragraph on page 9 (lines 17-26) and continuing on page 10 (lines 1-13) with the following rewritten paragraph:

In the publication, characteristic extraction comprising the histogram is carried out at the image segregation section for macro region recognition, but in the present case, the layout analysis is carried out on the basis of the recognition (micro recognition) signal of the neighborhood image dots, and macro recognition is carried out. That is, through the interface region recognition modifying section 7, the layout analysis is carried out by ~~CPU8~~ CPU 8, and the image recognition comprising the macro region will be carried out. In this way, the macro region recognized signal (photograph edge section is modified to the photograph based on the layout information and characters in the screened halftone image are also re-recognized) and modified recognition signals are stored in the recognition section of the memory element 5 again. The region recognition signal with compressed image signal and micro recognition signal stored in the memory element 5 modified by layout analysis has the compressed image signals entered the compression/depression section 4 entered, respectively, or the region recognition signal entered in the compression/depression section 6 of the region signal.

Please replace the last paragraph (lines 23-27) on page 10 and continuing on page 11 (lines 1-7) with the following rewritten paragraph:

The depressed image signal is entered in the inking section 9, and the YMCK signal is generated from the YMC signal. In such event, the black image and character is processed as a black character and signal processing different from regular inking is carried out. The inked signal is entered into the output gray-scale processing section 10 and  $\gamma$  characteristics are processed differently in ~~accord~~ accordance with characters and half tones, and the signal is outputted. Finally, this image information is transferred to a not-illustrated printer, an image is formed on the printing paper on the basis of this image information, and is outputted.

Please replace the last paragraph on page 11 (lines 8-27) with the following rewritten paragraph:

As described in detail as above, the image processing apparatus according to the present invention related to the first embodiment provides image processing to the image information entered. Because the region recognition is carried out with micro recognition signal (region recognition in conformity to neighborhood image information) of one screen received, remarkably high-accuracy region recognition is enabled. Furthermore, the apparatus can achieve image processing that simultaneously enables increased speed and improved accuracy by carrying out inking, gradation, modification for improving picture quality quickly and faithfully in compliance with the region recognition results, through simultaneously taking in original document image and recognizing the region by one scanning without carrying out scanning twice, prescanning for region recognition of the original document image and then final scanning of the original document image, as is the case of the conventional apparatus.

Please replace the second full paragraph on page 12 (lines 5-19) with the following rewritten paragraph:

First of all, a method for achieving improved picture quality using the density histogram is described. That is, the image signal is entered by the scanner, color-transformed, micro-recognized, noise-removed, and recognized for high-pass emphasizing. By this recognition signal, in the space filter 2, noise removal and high-pass emphasis are carried out, compression of image data is optimized in accordance with the recognition, and compressed

and stored in the image memory (the high-pass component main portion is stored in the high pass and the image data other than that is compressed by gray scale preservation parameters and stored). Simultaneously, the density histogram of the high-pass main portion and the density histogram of the portion other than that are created.

Please replace the last paragraph on page 17 (lines 13-27) and continuing on page 18 (lines 1-6) with the following rewritten paragraph:

Now discussion will be made on a method for improving the accuracy of the region recognition signal by setting the character mode, photograph mode, and other image modes at the operating section and changing the judgment threshold value in ~~accord~~ accordance with this setting. That is, the character mode and photograph mode are set at the operating section (control panel) 11, and the recognition judgment threshold value at ~~CPU8~~ CPU 8 is changed. For example, recognition parameters are changed in such a manner that the character on the screened halftone background is emphasized and recognized for easy reading of the character at the time of character mode. Furthermore, changes ~~will-e~~ will be made to add the  $\gamma$  characteristics to the recognition signal so that the character is outputted thick. In the photograph mode, the high-pass emphasis is reduced to eliminate rough feeling, and the  $\gamma$  characteristics are kept as much as faithful to suppress color fluctuations. By improving the accuracy of the region signal in this way, it becomes possible to improve the accuracy of the image processing results.

Please replace the second paragraph on page 19 (lines 8-20) with the following rewritten paragraph:

A second embodiment intends to reduce the cost of the image processing circuit by adding a resolution transformation section for transforming the resolution with respect to the image processing apparatus according to the first embodiment and making the use of the resolution transformation. FIG. 2 is a block diagram showing a configuration example of the second embodiment, in which the image processing apparatus is characterized in that it is clarified that the neighborhood recognition section is the ~~microrecognition~~ micro recognition

section 12 15 and the resolution transforming section is located between the inking section 9 and the output gray-scale processing section 10.

Please replace the last paragraph on page 19 (lines 21-27) and continuing on page 20 (lines 1-8) with the following rewritten paragraph:

For many of the natural pictures, nearly satisfactory picture quality is obtained from the visual viewpoint as far as the image is of 8-bit gray scale number (256 gradations) at 300 dpi resolution. On the other hand, for the character image, binary to ternary images are said to be required at 600 dpi. Therefore, it is considered to read the image input at 400 dpi at 256 gradations, use a printer at 600 dpi for the output, and output the image by providing gray scale processing. By doing so, the line buffer capacity for processing can be greatly ~~reduce~~ reduced in the apparatus cost in image processing. However, simply transforming the resolution may lose the sharpness of the character image and may result in inconvenience such as batter, etc. depending on characters.

Please replace the second paragraph on page 20 (lines 9-13) with the following rewritten paragraph:

Consequently, the image signal entered, for example, at 400 dpi and inked as shown in FIG. 1 has the resolution transformed to 600 dpi at the resolution transforming section newly shown in FIG. 2, and sent to the output gray scale processing section 10.

Please replace the last paragraph on page 20 (lines 14-27) and continuing on page 21 (lines 1-6) with the following rewritten paragraph:

In such event, the resolution transforming technique is changed over by the region recognition signal. To say specifically, the resolution transforming section 12 intends to transform the resolution by the space filter and linear transformation. The signal recognized as the character section by the recognition signal has the high-pass component emphasized by the space filter 2 and has the resolution transformed by linear interpolation. The photograph section has the high-pass component not so much emphasized in the space filter 2 by the recognition signal and has the resolution transformed by linear transformation. By doing this,

even smaller characters can be resolution-transformed to 600 dpi without battering and the character can be reproduced highly in detail and the photographs remarkably faithfully. According to circumstances, it is suitable to merge the resolution transforming section 12 with the output gray scale processing section 10.

Please replace the first paragraph on page 22 (lines 1-17) with the following rewritten paragraph:

According to ~~maerorecognition~~ macro recognition, the character region and the photograph region are recognized nearly accurately, respectively. Therefore, same as the embodiment of FIG. 1, the ~~image region recognition~~ image region recognition signal and the image signal are depressed and obtained, respectively, and supplied to the inking and color modifying section 9-2. Now, at the color modifying section, color transformation is carried out in such a manner that the character section is clear and the photograph section is given the natural gray scale free of battering. Because this color is originally transformed to the YMC signal and is not required to be changed in a full scale, the required color transformation is possible by changing, for example, the lower 4 bits only with the upper 4 bits held intact. By this method, faithful color modification is possible in a small-scale circuit.

Please replace the last paragraph on page 23 (lines 1-13) with the following rewritten paragraph:

That is, the page-by-page feature amount of the image information is found, and based on this, recognition is made as to whether the image information is black and white image by, for example, the ~~microrecognition~~ micro recognition section 14 15. When the image information is recognized as the black and white image, the region recognition signal stored is modified on the basis of the black and white image by the interface region recognition modifying section 7. Based on this modified region recognition signal, the image information is transformed to the black and white image, modified and outputted by the inking and color modifying section 9-2.

Please replace the last paragraph on page 28 (lines 8-23) with the following rewritten paragraph:

A sixth embodiment shows the case in which the printing control signal is created so that high picture quality is obtained at the time of printing in the image processing apparatus related to the first embodiment. FIG. 6 is a block diagram showing the configuration example of the sixth embodiment. In this drawing, the ~~microrecognition~~ micro recognition section 14 15 is designated as an attribute information recognition section 40, the compression/depression section 6 becomes the printing control signal depression section 41, the interface region recognition modifying section 7 is altered to an interface printing region modifying processing and parameter setting section 42, and the apparatus is connected to the network 43 via the external interface 13, which are structural differences from the first embodiment.